

AEROSOL PACKAGE

DESCRIPTION

CROSS-REFERENCE TO RELATED APPLICATIONS

[Para 1] This application is a continuation of U.S. Patent Application Serial No. 10/604,780, filed August 15, 2003, which claims the benefit of U.S. Provisional Application Serial No. 60/320,145, filed April 25, 2003, and U.S. Provisional Application Serial No. 60/319,548, filed September 13, 2002.

FIELD OF THE INVENTION

[Para 2] The invention relates to an aerosol package. In one of its aspects, the invention relates to an aerosol spray package comprising two containers and a dispenser having a dispensing orifice fluidly connected to dispensing outlets of the containers and an actuator for simultaneously dispensing fluids from the containers and through the dispensing orifice. In another aspect, the invention relates to an aerosol spray package comprising two containers and a dispenser with an ergonomic handle that is easy to use and ergonomically designed. In yet another of its aspects, the invention relates to an aerosol spray package comprising two containers and a dispenser with a unique and simple actuator to selectively and simultaneously dispense fluids from the containers through a dispensing orifice.

DESCRIPTION OF THE RELATED ART

[Para 3] The performance of cleaning compositions with an oxidizing agent deteriorates over a relatively short time if the reactive agents are stored together in a single chamber. For example, when an oxidizing agent is in a cleaning composition containing an activator, the oxidizing agent is stable for only a limited time period. Instability not only reduces the cleaning effectiveness of the composition but may also lead to increased pressure build-up causing the closed chamber to buckle or burst. As a result, various systems have been developed to separately store two-component cleaning compositions and mix the agents upon or immediately prior to application to the desired surface.

[Para 4] The Choy et al. U.S. Patent No. 5,767,055 discloses an apparatus for cleaning a hard surface, such as kitchen and bathroom tile, comprising a dual chamber bottle having a spray applicator for dispensing a mixture of compositions from each of the two chambers. One of the chambers contains a builder or chelating agent composition and the other chamber includes a hypohalite or hypohalite generator such as sodium hypochlorite as a bleaching agent. The two components of the composition are mixed upon spraying onto a surface.

[Para 5] The Kobyashi et al. U.S. Patent No. 5,869,440 and the Unilever PCT Publication No. WO 95/16023 both disclose two part bleaching compositions which comprise a peroxide composition and a detergent composition which are stored separately and sprayed onto hard surfaces at the time of combination.

[Para 6] The Van Dyck et al. U.S. Patent No. 3,635,372 discloses a housing mounting a pair of aerosol chambers, one containing an incapacitating fluid and the other containing a gas. The aerosol chambers have output valves that are connected through tubes to an output nozzle and a whistle. A trigger is pivotally mounted to the housing and moves laterally to displace a vertically movable actuator for simultaneously opening both aerosol valves in the chambers for dispensing the fluid and gas in the chambers.

[Para 7] The Breslau et al. U.S. Patent No. 3,303,970 and the Safianoff U.S. Patent No. 3,575,319 disclose a pair of aerosol dispensing chambers having different fluids that are dispensed through outlet valves connected through tubing to a single dispensing orifice. The outlet valves are actuated simultaneously by a trigger that is pivotally mounted to a frame that holds the aerosol chambers. Rotation of the trigger forces the valves downwardly to open the valves simultaneously.

[Para 8] Kasper et al. U.S. Patent No. 6,131,237 discloses a carpet extractor that has a liquid dispensing and a liquid recovery system. The liquid extraction system includes a clean water tank and a solution tank that are fluidly connected through a mixing valve for variable mixing of water with a cleaning solution. Kasper et al. '237 further discloses that an oxidizing agent, such as persalt, in conjunction with an activator such as tetra acetyl ethylene diamine (TAED), can be incorporated into the cleaning solution, either in the clean water tank, or into the cleaning solution tank. The mixture is then heated in an inline heater to raise the temperature of the detergent oxidizing agent solution into the range of 120–150°F. The oxidizing agent solution can be added to the solution tank and the cleaning solution can be added to the clean water tank. The cleaning solution and the oxidizing agent can then be mixed, heated and applied to the floor. The cleaning solution can be applied to the surface to be cleaned either through a spray nozzle or the nozzle of the accessory hose. The oxidizing agent can be used with or without the inline block heater. The oxidizing agent can be further used with or without the activating agent.

SUMMARY OF THE INVENTION

[Para 9] An aerosol package according to one embodiment of the invention for simultaneously dispensing two different fluids from separate chambers comprises a first container having a first fluid therein under pressure and having a first dispensing outlet controlled by a first valve; a second container,

in fixed abutting relationship to the first container, having a second fluid, different from the first fluid, therein under pressure and having a second dispensing outlet controlled by a second valve; and a dispenser having a dispensing orifice fluidly connected to each of the first and second dispensing outlets and an actuator connected to each of the first and second valves for simultaneously opening each of the first and second valves to simultaneously dispense fluids from the first and second containers.

[Para 10] In a preferred embodiment, the dispensing orifice is positioned at one side of the first container distal from the second container.

[Para 11] In yet another preferred embodiment, the two containers are joined together with an adhesive or with a thin film wrapped around them. Preferably, the film is at least partially transparent.

[Para 12] In another preferred embodiment, the dispenser comprises an integrally molded actuator body that includes the actuator, and the actuator is resiliently cantilevered from a portion of the actuator body.

[Para 13] In still another embodiment, the dispenser includes a dispensing tube with a channel between the first and second dispensing outlets and the dispensing orifice.

[Para 14] An aerosol package according to another embodiment of the invention for simultaneously dispensing two different fluids from separate chambers comprises a first container having a first fluid therein under pressure and having a first longitudinal axis and a first dispensing outlet controlled by a first valve; a second container, in fixed abutting relationship to the first container, having a second fluid, different from the first fluid, therein under pressure and having a second longitudinal axis lying in a plane common with the first longitudinal axis and a second dispensing outlet controlled by a second valve; and a dispenser mounted to the first and second containers. The dispenser comprises a dispensing tube fluidly connected to each of the first and second dispensing outlets and including a dispensing orifice lying within the common plane and adapted to dispense fluid along the common plane; an actuator connected to each of the first and second valves for simultaneously opening each of the first and second valves to simultaneously

dispense fluids from the first and second containers through the dispensing orifice; and a handle extending laterally of the first and second containers.

[Para 15] In a preferred embodiment, at least a portion of the handle is parallel to the first and second longitudinal axes.

[Para 16] In another embodiment, the dispenser comprises an integrally molded actuator body that includes the actuator, and the actuator is resiliently cantilevered from a portion of the actuator body.

[Para 17] In still another embodiment, the dispensing tube further includes a channel between the first and second dispensing outlets and the dispensing orifice and is adapted for vertical reciprocal movement relative to the first and the second containers. The dispensing tube preferably rests on the first and the second valves, and the actuator is adapted to depress the dispensing tube and thereby open the first and second valves.

[Para 18] In yet another embodiment, the dispensing orifice is positioned at one side of the first container distal from the second container.

[Para 19] In another embodiment, the dispenser further comprises a lock for selectively preventing the actuator from opening each of the first and the second valves. Preferably, the lock is integrally formed with the actuator. The lock is preferably frangible.

[Para 20] In another embodiment, the handle is adapted to be grasped by a user, and the actuator is shaped so that it can be depressed by a thumb of the user when grasping the handle. Preferably, at least a portion of the handle is parallel to the first and second longitudinal axes.

[Para 21] In still another embodiment, the first and second containers are snap-fit into the dispenser and supported thereby.

[Para 22] An aerosol package according to another embodiment of the invention for simultaneously dispensing two different fluids from separate chambers comprises a first container having a first fluid therein under pressure and having a first dispensing outlet controlled by a first valve; a second container, in fixed abutting relationship to the first container, having a second fluid, different from the first fluid, therein under pressure and having a

second dispensing outlet controlled by a second valve; and a dispenser mounted to the first and second containers. The dispenser comprises a dispensing tube fluidly connected to each of the first and second dispensing outlets and including a dispensing orifice adapted to dispense fluid; and an integrally molded actuator body that includes an actuator that is resiliently cantilevered from a portion of the actuator body and connected to each of the first and second valves for simultaneously opening each of the first and second valves to simultaneously dispense fluids from the first and second containers through the dispensing orifice.

[Para 23] In one embodiment, the first and the second containers have respective first and second longitudinal axes lying in a common plane, and the dispensing orifice lies within the common plane and is adapted to dispense fluid along the common plane.

[Para 24] In another embodiment, the dispensing tube rests on the first and the second valves and the actuator is adapted to depress the dispensing tube and thereby open the first and second valves.

[Para 25] In a preferred embodiment, an elongated filler is positioned within the dispensing tube to decrease the effective cross sectional area of the interior of the dispensing tube. Further, a plug is positioned in the dispensing orifice to assist in mixing the contents of the first and second containers as they are sprayed from the dispensing orifice.

BRIEF DESCRIPTION OF THE DRAWINGS

[Para 26] FIG. 1 is a perspective view of an aerosol dispenser according to the invention.

[Para 27] FIG. 2 is a schematic view in section of the aerosol dispenser illustrated in FIG. 1 taken along line 2-2 of FIG. 1.

[Para 28] FIG. 3 is a sectional view, like FIG. 2, of modified form of a dual aerosol dispenser according to the invention.

[Para 29] FIG. 4 is a perspective view of an alternative embodiment of an aerosol dispenser according to the invention.

[Para 30] FIG. 5 is an exploded view of the aerosol dispenser illustrated in FIG. 4.

[Para 31] FIG. 6 is a sectional view of the aerosol dispenser illustrated in FIG. 4 taken along line 6-6 of FIG. 4.

[Para 32] FIG. 6A is an enlarged view of the area in the circle 6A in FIG. 6.

[Para 33] FIG. 7 is a sectional view of a hollow conduit insert illustrated in FIG. 5.

[Para 34] FIG. 8 is a sectional view of a mechanical breakup plug of the hollow conduit insert illustrated in FIG. 5.

[Para 35] FIG. 9 is a sectional view of a terminal orifice of the hollow conduit insert illustrated in FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[Para 36] Referring now to the drawings, and to FIG. 1 and 2 in particular, there is shown an aerosol dispenser for dispensing cleaning compositions and oxidants from aerosol containers 10 and 14, which have conventional push valves 12 and 16 with outlet openings therein. Material selection for components coming in contact with the contents of the container depends upon the type of aerosol propellant and composition utilized in each container. The preferred propellant is dimethyl ether (C_2H_6O , also known as DME). DME is not compatible with nylon; therefore, when DME is the propellant, polypropylene is the preferred material for push valves 12, 16. Alternative propellants can be chosen from the hydrofluorocarbon (HFC) family and particularly 1,1-difluoroethane (CH_3CHF_2). A suitable commercially available

HFC is Dymel 152A from Dupont. When Dymel 152A is utilized, nylon is the preferred material for push valves 12, 16. A single valve orifice with a diameter in the range of 0.010 inches to 0.040 inches, and preferably 0.020 inches, is provided in each push valve 12, 16 to provide an adequate fluid flow therethrough. Alternatively, two valve orifices can be utilized in each push valve 12, 16, each with a diameter in the range of 0.010 inches to 0.040 inches, and preferably 0.020 inches. Preferably, containers 10, 14 are made from draw-formed aluminum to minimize the number of seams.

[Para 37] An inert material is applied to the inside surface of containers 10, 14 to physically separate the contents from the container surface. Reactions of peroxygen compounds with metal ions can produce gas that may undesirably increase the pressure inside the container. Furthermore, any reaction that may occur inside the container decreases the cleaning capability of the system because less active ingredient is available at the time of use. The preferred separator is applied on the surfaces of the container and some of the valve components that come in contact with the contents and is made from an inert polymer that is resistant to attack by peroxygen compositions and aerosol mixtures. Suitable commercially available products include epoxy phenolics such as Epon, polyamide-imides such as Pamasol, both available from Courtaulds Coatings, and vinyl organosols such as Micoflex available from Dexter International Corporation. In an alternate embodiment, the separator is a polyethylene or polypropylene bag or laminate that is sealed at the container outlet openings 12, 16. In another alternate embodiment, the separator is a laminate applied to the container surfaces and comprises inert materials such as polyethyleneterephthalate (PET) or polypropylene. In yet another alternative, the separator is formed by anodizing the interior surface of the aluminum container. Steel or tin-plated steel can be used as an alternative to aluminum; however, a separator as previously described is required due to the high reactivity of ferrous ions with peroxygen compositions.

[Para 38] A dispensing head 36 has at a lower portion thereof a retaining skirt 38, which is adapted to releasably retain aerosol containers 10 and 14. The dispensing head 36 further has a grip 40 that extends upwardly from the

retaining skirt 38 and forms a hand grip for the user of the dispenser. A head 42 is connected to the top of the grip 40 and has a spray nozzle 44 at one end thereof. A cam trigger 28 is mounted to the grip 40 beneath the head 42.

[Para 39] As illustrated in FIG. 2, the skirt 38 mounts a pressure plate 18 for vertical reciprocatory movement therein. The pressure plate 18 has openings 46 and 48 in register with the push valves 12 and 16, respectively. The openings 46 and 48 are connected through tubes 22 and 24 to a mixing tube 26 that terminates in the spray nozzle 44. The cam trigger 28 is pivotally mounted to the grip 40 through a pivot pin 30. The cam trigger 28 has a lower cam surface 50 that interfaces with a cam follower 20.

[Para 40] As the cam trigger 28 is squeezed inwardly, it forces the cam follower 20 and, thus, the pressure plate 18 downwardly to simultaneously open the push valves 12 and 16. Thus, equal amounts of the solution in the aerosol containers 10 and 14 are simultaneously dispensed through the tubes 22 and 24 respectively and into the mixing tube 26. The mixed solutions are sprayed through the spray nozzle 44 on to a surface to be cleaned.

[Para 41] Referring now to FIG. 3, where like numerals have been used to designate like parts, the pressure plate 18 is mounted for horizontal translational movement with respect to the skirt 38. The cam trigger 32 has a cam finger 34, which is pivotally mounted to the pressure plate 18. Thus, as the cam trigger 32 is squeezed and rotates about the pivot pin 30, the pressure plate 18 will be translated horizontally and to the right as viewed in FIG. 3 to open the valves 12 and 16. In this manner, predetermined proportions of solutions in the aerosol containers 10 and 14 are simultaneously dispensed through the tubes 22 and 24 respectively, and into the mixing tube 26 from which the mixture is dispensed through the spray nozzle 44.

[Para 42] Referring now to FIGS. 4 through 9, there is shown an alternative embodiment of an aerosol dispenser 60 comprising a push valve assembly 110 for each container 10, 14, an actuator top 62, a handle base 64, and a dispensing tube 66. Aerosol containers 10 and 14 are releasably mounted within the handle base 64.

[Para 43] As shown in FIGS. 4 and 5, the containers 10 and 14 are preferably cylindrical containers. Accordingly, each container 10 and 14 includes a longitudinal axis that extends along the length thereof. The longitudinal axes can be positioned in the center of the containers 10 and 14 or offset from the center of the containers 10 and 14. Further, the longitudinal axes of the containers 10, 14 lie in a common plane. Preferably, the longitudinal axes are coincident with the center of the containers 10 and 14 and, therefore, the common plane bisects the containers 10 and 14. However, it is within the scope of the invention for the common plane to be located elsewhere in the containers 10 and 14.

[Para 44] As depicted in FIGS. 6 and 6A, the push valve assembly 110 comprises a valve cup 112, a stem 114, a housing 116, a gasket 118, a spring 120, and a dip tube 122. The valve cup 112 has an annular lip sized to receive and close the open end of the container 10 or 14. Further, the center of the valve cup 112 has an opening 126 therethrough. Preferably, the valve cup 112 is formed of the same material as the containers 10, 14 and lined with a suitable separator material as described above for the containers. Specifically, the container 10, 14 and valve cup 112 are made of the same material type and preferably are comprised of aluminum. Alternatively, these components can be made of steel or zinc-plated steel. Valve cup 112 may optionally comprise a separator, or liner, as described above. The valve stem 114 is mounted to a solid plunger 124 at a lower end and is hollow with preferably one, and optionally two, valve orifices 126 located in the side wall thereof near the bottom end thereof and in fluid communication with the interior of the hollow stem 114. The valve stem 114 is received in an opening 126 of the valve cup 112, with a gasket 118 located between the plunger 124 and the cup 112. The housing 116 has a hollow cylindrical upper portion, a reduced diameter hollow lower portion, and a flange therebetween. The housing 116 surrounds the stem 114 and the gasket 118 at its upper end, and is secured in place by the valve cup 112. Inside the housing 116, the spring 120 is positioned between the lower end of the plunger 124 and the flange of the housing 116 and biases the gasket 118 against the valve cup 112 which forms a seat for the valve. For the oxidizing compound container 14, the housing

116 further includes a vapor tap orifice 119 therethrough in the range of 0.001 to 0.020 inches in diameter and preferably 0.005 inches. The vapor tap orifice 119 vents excess pressure created by the oxidizing compound reacting with contaminants. When the valve stem 114 is depressed, excess vapor pressure is vented through the valve stem 114 before the oxidizing compound is dispensed. The hollow dip tubes 122 are connected to and in fluid communication with the lower portions of the housings 116 and extend to the bottom of the containers 10 and 14 to fill the housings 116 with liquid from the containers under pressure from the aerosol in the containers.

[Para 45] The stems 114, plungers 124, the dip tubes 122 and the housings 116 can be made from nylon or polypropylene depending upon the propellant used and the nature of the composition. In the cleaning composition, any propellant can be used and nylon is the preferred material for the stem 114, plunger 124, the dip tube 122 and housing 116. In the peroxygen container, nylon is preferred when HFC is the aerosol propellant. Polypropylene may be used when any propellant other than HFC is utilized. The gasket 118 is preferably formed from a resilient material, such as Buna-Nitrile (Buna-N) rubber or Butyl rubber, common gasket materials used in the aerosol dispenser industry. However, due to the reactive nature of the oxidizing compound, ethylene propylene diene terpolymer (EPDM) is the preferred gasket 118 material for the oxidizing compound container 14. The spring 120 and the dip tube 122 are preferably composed of stainless steel and polyethylene, respectively. The invention should not be limited to type of push valve assembly 110 described herein, and other push valves well known to those skilled in the art can be utilized with the aerosol dispenser.

[Para 46] The actuator top 62 has a cover housing 70 with an integrally formed actuator finger 72 and a thumb tab 74. The actuator finger 72 is separated along its sides by slots 76, has cam levers 78 that extend downward therefrom, and is resiliently cantilevered from a front portion of the cover housing 70. The actuator top 62 is formed from a resilient plastic material, preferably by injection molding.

[Para 47] The handle base 64, best shown in FIG. 5, comprises an outer wall 80 having a slot 82 at one end in which is mounted the end of the dispensing tube 66. The handle base 64 further comprises a pair of arcuate inner walls 84, which with outer wall 80 forms cylindrical sockets for receiving the aerosol containers 10 and 14 in a snap-fit manner. The arcuate inner walls 84 each have a vertical slot extending from a top portion substantially identical with the slot 82 in the outer wall 80. A handle 88 is integrally formed with the outer wall 80 and is designed so that a user can grip the handle 88 with his or her hand and apply thumb pressure at thumb tab 74 to the actuator finger 72. As shown in FIGS. 4-6, the handle 88 extends laterally from the handle base 64 such that at least a portion of the handle 88 projects laterally from the containers 10 and 14. Additionally, at least a portion of the handle 88 is preferably parallel with the longitudinal axes of the containers 10 and 14, which facilitates the user gripping the handle 88 with the hand and applying thumb pressure at the thumb tab 74, as described above. Further, when the user grasps the handle 88 in this manner, the user's wrist is in an ergonomically correct, generally straight or neutral position. An integral lock 73 can be formed on an outer end of the actuator finger 72 and project downwardly thereof to abut the handle 88 and prevent accidental depression of the actuator finger 72 prior to sale and use of the dispenser. The integral lock 73 can be attached to the handle 88 with a frangible connection. Upon an intentional act by the user, the integral lock may be disengaged or removed when it is desirable to dispense the contents of the aerosol containers 10 and 14.

[Para 48] Referring to FIGS. 5-9, the dispensing tube 66, preferably formed from polypropylene, comprises connecting tubes 92 in fluid communication with the interior of a hollow conduit 90 having a closed end 94 and a nozzle end 96. The connecting tubes 92 have an open lower end sized to receive the hollow upper end of the valve stem 114. The dispensing tube 66 rests on the valve stems 114 so that downward vertical movement of the dispensing tube 66 simultaneously pushes the valve stems 114 and the plungers 124 into the housings 116 to thereby open the push valve assemblies 110. Dispensing tube 66 further comprises a solid conduit insert 102. Solid

conduit insert 102 is a rod shaped structure that fits tightly against an upper wall of the hollow conduit 90 but leaves a cavity 103 of a predetermined volume at a lower wall of the hollow conduit 90. The cavity is in fluid communication with connecting tubes 92 and, therefore, with the hollow upper end of the valve stem 114. A mechanical breakup plug 104, best seen in FIG. 7 and 8, is integrally formed on one end of the conduit insert 102 and is positioned within the nozzle end 96. A spray aperture 106 of a predetermined size is formed at a lower portion of the mechanical breakup plug 104 and aligned with the cavity 103.

[Para 49] The solid conduit insert 102 takes up volume of the interior of the dispensing tube 66 so that there is a relatively small volume of the two ingredients mixed and held in the dispensing tube 66 between the dip tubes 122 and the nozzle end 96. The solid conduit insert 102 avoids any potential reaction of the peroxide in the dispensing tube 66 that may cause foaming and dribbling of the solution after the user releases the actuator finger 72.

[Para 50] The dispensing tube 66 in this design is not only a conduit, but also a structural part that transfers the force from the single fulcrum actuator finger 72 to the two push valve assemblies 110 with minimal deflection. In order to make the dispensing tube 66 strong requires a relatively large box section, which unfortunately creates too much volume inside. To solve this problem economically, a mechanical filler and break-up structure is used in the relatively large dispensing tube 66.

[Para 51] A terminal orifice 100, best seen in FIG. 9, is fixedly attached to the mechanical breakup plug 104 and comprises an at least one generally circular terminal aperture 108, preferably having a diameter in the range of 0.020 to 0.040 inches, therethrough that is in fluid communication with the spray aperture 106 and, therefore, the cavity 103 and the connecting tubes 92. The mechanical breakup plug and the terminal orifice force a disrupted flow pattern at the nozzle end 96 of the hollow conduit 90 wherein the contents are mixed and delivered under pressure to the surface to be cleaned.

[Para 52] In the preferred embodiment, the containers 10, 14 are aligned so that the oxidizing compound container 14 is located farthest away from the

mechanical breakup plug 104. In other words, and as shown in FIGS. 4–6, the terminal orifice 100 is located at one side of the cleaning composition container 10 and is distal from the oxidizing compound container 14. Further, the terminal orifice 100 preferably lies within the common plane of the longitudinal axes of the containers 10 and 14 such that fluid is dispensed through the terminal aperture 108 in the terminal orifice 100 in a direction along the common plane. As discussed above, the common plane can bisect the containers 10 and 14 or can be offset from the centers of the containers 10 and 14. The containers 10, 14 are attached to one another with a suitable hot melt adhesive 109. A label 111 made from a stretched thermoplastic film material is wrapped around the outside of the two containers 10, 14 and is shrunk fit by a heat source to conform to the outer container walls. In addition to being a suitable surface for displaying marketing graphics, the label 111 provides structural integrity to the arrangement of the cleaning and oxidizing composition containers 10, 14 to maintain alignment of the containers 10, 14 during use. Furthermore, some or all of the label material may be transparent so that the containers 10, 14 are visible to the user.

[Para 53] A wide variety of adhesives can be used to join the containers 10 and 14 together. A suitable adhesive is a Bostik Findley hot melt adhesive sold under the product designation H2790. It has a softening point of 155° F (68°C), a suggested running temperature of 279–300°F (135–149°C) and a viscosity of 1200–750 cPs @ 275–300°F (135–149°C).

[Para 54] The sealed and pressurized container 14 is capable of containing excessive pressure created if the oxidant should come in contact with a reactant inside the container, such as flaws in the separator material, contact with an activator, or trace contaminants in the compounding solvents. The container is designed to an aerosol industry standard 18 bar strength level to provide an adequate safety margin. In the preferred embodiment, the container buckle strength is no less than 250 psi and the burst strength no less than 320 psi.

[Para 55] In operation, the aerosol containers 10 and 14 are equipped with the push valve assemblies 110 by attaching the cups 112 thereto and are

releasably mounted within the outer walls 80 of the aerosol dispenser 60 so that the valve stems 114 are seated within the open outer end of the connecting tubes 92. The dispensing tube 66 fits within the slot 82 in the outer wall 80 and within the slots in the arcuate inner walls 84 for vertical reciprocatory movement therein. The top surface of the dispensing tube 66 abuts the underside of the cam levers 78. When a user grips the handle 88 and depresses the actuator finger 72 through thumb pressure at the thumb tab 74, the cam levers 78 are driven downwardly with respect to the handle base 64 to depress the dispensing tube 66 and thereby depress the valve stems 114 and the springs 120 so that the valve orifices in the stems 114 are positioned below the gasket 118. In this configuration, the valve orifices are in fluid communication with the housing 116 and the dip tube 122. As a result, the contents of the aerosol container are respectively dispensed in equal proportion through the push valve assembly 100 via the dip tube 122, the housing 116, the valve orifices, and the hollow upper end of the stem 114; through the connecting tubes 92; through the cavity 103 of the hollow conduit 90; through the spray aperture 106 of the mechanical breakup plug 104, and through the terminal aperture 108 in a direction along the common plane. The pressure in the aerosol containers 10 and 14 forces the mixture of cleaning solution and oxidizing solution through the terminal aperture 108 in a spray pattern to spray on a carpet or fabric surface. When the pressure on the actuator finger 72 is released, the dispensing tube 66 rises in the slots 82 and 86 under spring pressure from the push valve assemblies 110 to cease the flow of the cleaning composition and the oxidizing composition from the aerosol containers 10 and 14.

[Para 56] The proper combination of valve orifice size, cavity 103, terminal aperture 108 size, and propellant pressure are required to achieve the desired ratio and flow rate of cleaning compositions and oxidants and spray pattern for a given distance from the surface to be cleaned. Preferably, a 1:1 ratio of cleaning composition and oxidant is dispensed at a flow rate of 3 – 8 grams per second, preferably 5 grams per second, in a circular spray pattern having a diameter less than 2 inches when the containers 10, 14 are 2 feet away from the target surface.

[Para 57] A fabric/carpet cleaning formula composition for removing stains and soil from carpets and fabrics such as upholstery fabrics is filled into one of the aerosol containers. This composition includes one or more cleaning solvents, a surfactant, de-ionized water and, optionally, a fragrance.

According to the invention, the cleaning composition further includes a pH adjusting agent to maintain a pH in the cleaning solution between 7.5 and 12.0 in order to trigger release of oxygen in the oxidizing composition. The cleaning composition can also include an anti-stain and/or anti-resoil agent. An example of the anti-stain protectant is PM 1874, a sulfo-methacrylate resin, manufactured by the 3M Company. An example of the anti-soil component is PM 1870, a polysiloxane derivative in the silsesquioxane chemical family, also manufactured by the 3M Company. Other components may include acrylic polymers.

[Para 58] De-ionized water is preferred as the solvent medium for the cleaning composition. The de-ionized water minimizes contamination of the cleaning solution from trace minerals in the water. One advantage of using de-ionized water as a solvent is that it evaporates with little or no residue after delivering cleaning agents to the carpet or upholstery. Alternative cleaning solvents can be one or more glycol ethers, for example dipropylene glycol monomethyl ether, or Glycol Ether DPM, and propylene glycol normal propyl ether, Glycol Ether PNP, or one of the terpenes such as natural terpenes including d-limonene. These components can be present in the cleaning composition in effective amounts. For example, the Glycol Ether DPM can be present in the range of 0.5 to 1.5, preferably 0.8 wt. % in the composition. Glycol Ether PNP can be present in the range of 0.8–15.0, preferably 7.2 wt. %. D-limonene, when used, can be present in the range of 0.1 to 5.0, preferably 0.3 wt. % in the composition.

[Para 59] Non-ionic surfactants can be present in a range of about 0.1 to 2.0. Tomadol 23–6.5, a non-ionic surfactant comprising ethylene oxide attached to lineal alcohol, is preferably present at about 0.8 wt. %. Alternatively, Neodol 23–6.5, another alcohol ether, can be present at about 1.8 wt. %.

[Para 60] The EDTA can be present in amounts between about 0.1 and 5.0, preferably 0.4 wt %, in compositions that include 40% EDTA solution.

[Para 61] In the aerosol propelled composition embodiment, the propellant for both containers is preferably dimethyl ether (C_2H_6O , also known as DME). An alternative propellant can be the hydrofluorocarbon (HFC) family, particularly 1,1-difluoroethane (CH_3CHF_2). A suitable commercially available HFC is Dymel 152A from Dupont. The concentration of Dymel 152A in the cleaning composition can be in the range of 1% – 25% by weight and preferably 5%. Yet other alternative propellants include hydrocarbons such as isobutane (C_4H_{10}), propane (C_3H_8), and liquefied petroleum gas; and natural gases including compressed air, carbon dioxide, and nitrogen.

[Para 62] Pressurization within the cleaning composition container can range from 1 to 100 pounds per square inch (psi). When DME is the propellant, dual 0.020 inch push valve orifices and an internal pressure of 45 psi are preferred. When a HFC propellant is used, a single 0.020 inch orifice is employed at an internal pressure of 70 psi.

[Para 63] The pH adjusting agent is also used to remove trace amounts of iron and other contaminants. A typical pH agent is EDTA (ethylenedinitramine). Other suitable pH agents include disodium EDTA, an example of which is Hampene Na₂.

[Para 64] The cleaning composition can further include an activator for the oxidizing composition. The preferred activator is sodium carbonate, however, other suitable activators include metals ions, metals salts, and other carbonates such as sodium bicarbonate. Still other suitable activators include tetraacetylenediamine, sodium octanoyloxybenzene sulfonate, sodium nonanoyloxybenzene sulfonate, sodium decanoyloxybenzene sulfonate, (6-octanamido-caproyl) oxybenzenesulfonate, (6-nonanamido-caproyl) oxybenzenesulfonate, 6-decanamido-caproyl) oxybenzenesulfonate, and mixtures thereof. In the preferred embodiment, sodium carbonate can be added as an activator in an amount of at least 0.1 wt. % and preferably 0.5 wt. % to reach a stoichiometric ratio of activator to reactant.

[Para 65] The cleaning composition can also include anionic surfactants that create a friable residue that can be vacuumed after the cleaning process. A suitable anionic surfactant is sodium lauroyl sarcosinate, such as Hamposyl L-30 Type 724, and can be present in suitable amounts, for example between 1.0 and 6.0, preferably 3.3 wt. %.

[Para 66] In addition to the foregoing, the cleaning composition can further include a dispersant for soil and a further pH stabilizer such as Alcosperse 602N, which is an acrylate polymer.

[Para 67] The oxidizing composition is filled into the other aerosol container and includes de-ionized water, a peroxygen compound, a stabilizer and, optionally, anti-soil and/or anti-stain protectants. An example of the anti-stain protectant is PM 1874, manufactured by the 3M Company. An example of the anti-soil component is PM 1870 from the silsesquioxane chemical family, also manufactured by the 3M Company. Other components may include acrylic polymers. Suitable soil-resist or anti-soil compositions are disclosed in the U.S. Patent No. 5,888,290, which is incorporated herein by reference.

[Para 68] The de-ionized water in the oxidizing solution is present in a range of about 70 to about 99 wt. %, preferably about 88.3 wt. %. De-ionized water is important in the oxidizing solution to minimize contaminants that will initiate activation inside the container, reducing the cleaning efficacy of the composition and creating an undesirable increase in internal pressure. The peroxygen compound can be present in a range of about 0.4% to 29%, preferably 11.4%, of the active ingredients resulting in a total fill concentration of about 0.1% – 10% by weight with a preferred value of about 4 wt. %.

[Para 69] The peroxygen compound is preferably a cosmetic grade hydrogen peroxide (H_2O_2), however other peroxygen compounds can be used. A suitable commercially available 35% cosmetic grade hydrogen peroxide is available from the Degussa Company and is preferred because of its superior stability characteristics and extended shelf life. Other suitable hydrogen peroxides are available from Solvay Interlox. Yet another suitable hydrogen peroxide is provided by FMC Industrial Chemicals under the trade names Hybrite 32.5%,

Durox, Oxypure 35%, Standard 27.5 35%, Super D 25 and 35, Technical 35%, Chlorate Grade 20%, Semiconductor Reg, Seg, RGS, RGS 2, RGS 2, 31%.

Alternatively, the peroxygen compound can be a preformed peracid compound selected from the group consisting of percarboxylic acid and salts, percarbonic acids and salts, perimidic acids and salts, peroxymonosulfuric acids and salts, and mixtures thereof; a persalt such as perborate compounds, percarbonate compounds, perphosphate compounds and mixtures thereof; or a peroxide compound.

[Para 70] The anti-stain ingredient in the oxidizing solution can be present in about 1 to 5 wt. %, typically about 1.7 wt. %. The anti-soil ingredient is typically present in less than 1 % by weight, typically about 0.3 wt. % in the composition.

[Para 71] The pH stabilizer will maintain the oxidizing composition at a pH level in the range of 1.5 to 8.5, preferably about 6.8. Pentasodium diethylenetriamine pentaacetate, for example Versenex 80, is an appropriate pH stabilizer when oxidative conditions exist. It will also neutralize any trace elements of contaminants in the oxidizing composition.

[Para 72] The aerosol propellant for the oxidizing composition is preferably dimethyl ether (C_2H_6O , also known as DME). Alternative propellants may be chosen from the hydrofluorocarbon (HFC) family, hydrocarbons, and natural gasses. A suitable HFC is 1,1-difluoroethane (CH_3CHF_2), commercially available as Dymel 152A from Dupont. The concentration of Dymel 152A in the oxidizing composition can be in the range of 1% – 25% by weight, preferably 5%. A particularly suitable hydrocarbon is N-Butane (C_4H_{10}). Alternative hydrocarbon materials include isobutane (C_4H_{10}), propane (C_3H_8), and liquefied petroleum gas. Natural gases include compressed air, carbon dioxide, and nitrogen.

[Para 73] Pressurization within the oxidizing container can range from 1 to 100 pounds per square inch (psi). When DME is the propellant, a single 0.024 inch orifice is preferred at a preferred pressure of about 45 psi. Alternatively, dual 0.020 inch orifices can be employed with DME. When HFC is the

propellant, a single valve orifice of 0.018 inches is used and the preferred pressure is about 70 psi.

[Para 74] The pH values of the cleaning composition and the oxidizing composition can vary over a wide range but are selected, taking into consideration the volume of each composition that is dispensed simultaneously, so that the pH of the combined cleaning composition and the oxidizing composition is sufficiently greater than 7 to activate the discharge of oxygen from the oxidizing solution for enhanced cleaning of the carpet surface. In a preferred embodiment the pH is the combined cleaning composition and the cleaning composition is greater than 8, preferably about 8.3.

[Para 75] Examples

[Para 76] Spot cleaning compositions were prepared with the following ingredients in Table 1:

[Para 77] Table 1 – Cleaning Compositions

Ingredients	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>
Deionized Water	83.4 0	83.6 7	82.9 0	83.4 0	83.5 0	83.8 0	90.8 0
Sodium Carbonate	0.50	0.40	0.50	0.50	0.50		
Dowanol PNP ¹	15.0 0	15.0 0	14.7 0	15.0 0	14.8 0	15.0 0	
Fragrance ²	0.10	0.10				0.10	0.10
Tomadol 23–6.5 ³	0.80	0.66	0.80	0.66	0.80	0.60	0.70
Petro ULF ⁴	0.20	0.17	0.80	0.34	0.20		
d-limonene			0.30	0.10	0.30		
EDTA, 40%						0.40	0.40

Glycol Ether DPM							0.80
Glycol Ether PNP							7.20
Hampene Na2 ⁵							
Neodol 23-6.5 ⁶							
Hamposyl L-30 Type 724 ⁷							
Alcosperse 602N ⁸							

[Para 78] ¹ Glycol ether, a solvent, manufactured by Dow Chemical Company

[Para 79] ² Sapphire fragrance, manufactured by Firmenich

[Para 80] ³ Linear primary alcohol ethoxylate, a non-ionic surfactant, manufactured by Tomah Chemical Company

[Para 81] ⁴ Sodium alkyl naphthelene sulfonate from AKZO Nobel

[Para 82] ⁵ Disodium EDTA, manufactured by Hampshire Chemical

[Para 83] ⁶ Alcohol ether, a non-ionic surfactant, manufactured by Shell Chemicals

[Para 84] ⁷ Sodium lauroyl sarcosinate, an anionic surfactant, manufactured by Hampshire Chemical

[Para 85] ⁸ Acrylate polymer, a pH stabilizer, manufactured by Alco Chemical

[Para 86] Table 1 - Cleaning Compositions (continued)

Ingredients	<u>H</u>	<u>I</u>	<u>J</u>	<u>K</u>	<u>L</u>	<u>M</u>	<u>N</u>
Deionized Water	89.3	88.8	85.8	82.9	82.9	87.0	89.7
	5	5	0	0	0	0	0
Sodium Carbonate							
Dowanol PNP ¹							

Fragrance ²	0.05	0.05	0.10	0.10	0.10	0.10	0.10
Tomadol 23-6.5 ³							
Petro ULF ⁴							
d-limonene							
EDTA, 40%							
Glycol Ether DPM	0.50	0.50	0.80	1.50		7.20	0.80
Glycol Ether PNP	4.50	4.50	7.20	13.50	15.00	0.80	7.20
Hampene Na ²⁵	0.50						
Neodol 23-6.5 ⁶	1.80	1.80	1.80	1.00	1.00	0.40	0.70
Hamosyl L-30 Type 724 ⁷	3.30	3.30	3.30			3.00	
Alcosperse 602N ⁸		1.00	1.00	1.00	1.00	1.50	1.50

[Para 87] ¹ Glycol ether, a solvent, manufactured by Dow Chemical Company

[Para 88] ² Sapphire fragrance, manufactured by Firmenich

[Para 89] ³ Linear primary alcohol ethoxylate, a non-ionic surfactant, manufactured by Tomah Chemical Company

[Para 90] ⁴ Sodium alkyl naphthelene sulfonate from AKZO Nobel

[Para 91] ⁵ Disodium EDTA, manufactured by Hampshire Chemical

[Para 92] ⁶ Alcohol ether, a non-ionic surfactant, manufactured by Shell Chemicals

[Para 93] ⁷ Sodium lauroyl sarcosinate, an anionic surfactant, manufactured by Hampshire Chemical

[Para 94] ⁸ Acrylate polymer, a pH stabilizer, manufactured by Alco Chemical

[Para 95] Table 1 – Cleaning Compositions (continued)

Ingredients	<u>Q</u>	<u>P</u>
Deionized Water	89.9	90.8 0
Sodium Carbonate		
Dowanol PNP ¹		
Fragrance ²	0.10	0.10
Tomadol 23–6.5 ³		
Petro ULF ⁴		
d–limonene		
EDTA, 40%	0.50	0.40
Glycol Ether DPM	7.20	0.80
Glycol Ether PNP	0.80	7.20
Hampene Na ²⁵		
Neodol 23–6.5 ⁶	0.50	0.70
Hamposyl L–30 Type 724 ⁷	1.00	
Alcosperse 602N ⁸		

[Para 96] ¹ Glycol ether, a solvent, manufactured by Dow Chemical Company

[Para 97] ² Sapphire fragrance, manufactured by Firmenich

[Para 98] ³ Linear primary alcohol ethoxylate, a non–ionic surfactant, manufactured by Tomah Chemical Company

[Para 99] ⁴ Sodium alkyl naphthelene sulfonate from AKZO Nobel

[Para 100] ⁵ Disodium EDTA, manufactured by Hampshire Chemical

[Para 101] ⁶ Alcohol ether, a non-ionic surfactant, manufactured by Shell Chemicals

[Para 102] ⁷ Sodium lauroyl sarcosinate, an anionic surfactant, manufactured by Hampshire Chemical

[Para 103] ⁸ Acrylate polymer, a pH stabilizer, manufactured by Alco Chemical

[Para 104] For all of the samples, the pH of the cleaning composition was 11.3 ± 0.3 .

[Para 105] The compositions of the oxidizing solutions were as follows in Table 2:

[Para 106] Table 2 – Oxidizing Solutions

Ingredients	<u>A</u>	<u>B</u>	<u>C</u>
Deionized Water	88.30	77.70	79.70
Hydrogen Peroxide, Cosmetic Grade 35%	11.40	20.00	20.00
Versenex 80 ¹	0.30	0.30	0.30
PM 1874 ²		1.70	
PM 1870 ³		0.30	

[Para 107] ¹ Pentasodium diethylenetriamine pentaacetate, a pH stabilizer, manufactured by Dow Chemical Company

[Para 108] ² Sulfo-methacrylic polymer, an anti-stain protectants, manufactured by the 3M Company

[Para 109] ³ Polysilosane derivative, an anti-soil ingredient, manufactured by the 3M Company

[Para 110] For all of the samples, the pH of the oxidizing solution was 6.8 ± 0.3 .

[Para 111] Any of the cleaning compositions may be combined with any of the oxidizing solutions to achieve acceptable cleaning results. The preferred combinations are shown in Table 3. Although any combination of cleaner and oxidizer will result in acceptable results, each combination exhibits different characteristics. From a chemistry perspective, the technically superior result is a combination of cleaner A and oxidizer A. However, when cost of ingredients is taken into account, cleaner F combined with oxidizer A is the best choice for consumer value. The best cleaning performance was exhibited by cleaner A combined with oxidizer C, and the best protection was provided by cleaner A combined with oxidizer B.

[Para 112] Table 3 – Preferred Combinations

Composition	<u>TECHNICALLY</u>	<u>SUPERIOR</u>	<u>SUPERIOR</u>	<u>MARKET</u>
	<u>SUPERIOR</u>	<u>CLEANER</u>	<u>PROTECTION</u>	<u>CHOICE</u>
Cleaning Composition	A	A	A	F
Oxidizing Solution	A	C	B	A

[Para 113] The pH of the combined cleaning composition and oxidizing solution as expelled for all samples was 8.3 ± 0.3 .

[Para 114] Test Method

[Para 115] Two separate containers were partially filled with the carpet cleaning solution and the oxidizing solution. The containers were then partially filled with an aerosol propellant. The two compositions were then dispensed through a common spray nozzle onto carpet samples that had been pretreated with stains from red wine, grape juice, spaghetti sauce, chocolate syrup, red lipstick, and blue ballpoint pen ink. The carpets were scrubbed moderately with a brush and then were vacuumed with a suction cleaner to remove the soiled solution. Cleaning was measured using a calibrated spectrophotometer on the stain at both the front and back of the carpet sample. Results were calculated as ΔE , the difference in spectrophotometer readings from the clean, virgin carpet and the carpet after the stain was removed ($\Delta E = \text{virgin reading} - \text{cleaned reading}$). The lower the ΔE value, the less stain remains. The stains were satisfactorily removed. The average results for each stain for the preferred combination of cleaner C and oxidizer A (Market Choice from Table 3) are presented in Table 4.

[Para 116] Table 4 – Results of Significant Outcomes for Market Choice

Stain	ΔE VALUE – FRONT
	MARKET CHOICE

Grape Juice	2.97
Koolaid (Cherry)	8.03
Coffee	5.99
Red Wine	3.72
Cola	1.59
Lipstick (Red)	15.97
Spaghetti	13.67
Black Ink	44.25
Dirty Motor Oil	21.26
Chocolate Syrup	27.27

[Para 117] Whereas the invention has been described with respect to an aerosol dispensing package for the cleaning solution and oxidizing solution, many other delivery forms can be used. For example, a dual siphon manual trigger dispenser having a fixed or variable ratio can be used. Such manual trigger dispensers are disclosed in U.S. Patent Nos. 5,332,157, 4,862,052, 4,821,923 and 4,432,469, all of which are incorporated herein by reference.

[Para 118] The cleaning solution and oxidizing solution can be dispensed from separate squeeze containers. For example, a dual chamber blow molded bottle, such as disclosed in U.S. Patent Nos. 5,676,055, 4,835,804, 4,776,972 or 4,720,351 can be used.

[Para 119] The trigger can be battery powered as well as being manual. It can have a fixed or variable ratio.

[Para 120] Another alternative container and dispensing system for the cleaning composition and oxidizing compositions according to the invention is a dual chamber squeeze bottle as, for example disclosed in U.S. Patent No. 4,585,149 or 6,216,915, both of which patents are incorporated herein by reference.

[Para 121] Anti-stain compositions according to the invention are disclosed in U.S. Patent No. 5,948,480. Anti-soil compositions used in the invention are disclosed in U.S. Patent No. 6043209, 5,534,167, 5,888,290, all of which are enclosed herewith by reference.

[Para 122] Still further, the cleaning and/or oxidizing solution can themselves contain components which, when mixed, generate heat so that the cleaning and oxidizing solution applied to a surface are applied at elevated temperatures. Examples of compositions and systems for generating heat in the cleaning and/or oxidizing solutions are disclosed in U.S. Publication No. US-2003-0075203-A1, which was published on April 24, 2003, and is incorporated herein by reference.

[Para 123] Reasonable variation and modification are possible within the forgoing disclosure and drawings without departing from the spirit of the invention that is defined in the appended claims.